Enterprise Library Software

Introducing ELS

Version 7.1

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Preface

Oracle's StorageTek™ Enterprise Library Software (ELS) is a solution consisting of the following base software:

- StorageTek™ Storage Management Component (SMC)
- StorageTek™ Host Software Component (HSC)
- StorageTek™ Virtual Tape Control Software (VTCS)
- StorageTek™ Concurrent Disaster Recovery Test (CDRT)

Additionally, the following software is provided with the ELS package:

- StorageTek™ Library Content Manager (LCM) (formerly ExLM). LCM includes an enhanced version of the product formerly known as Offsite Vault Feature.
- StorageTek™ Client System Component for MVS Environments (MVS/CSC)
- StorageTek™ LibraryStation

Refer to the publication *Introducing ELS* for an overview of the ELS solution.

Audience

This book presents information for anyone involved in planning for and implementing an ELS solution. This audience could include MIS managers, system programmers, storage administrators, and performance specialists.

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Information Map for *Introducing ELS*

TABLE P-1 Information Map for Introducing ELS

Chapter 1, “What is Enterprise Library Software?”	Introducing ELS and its software components.
Chapter 2, “How Does ELS Work?”	How the ELS components work together.
Chapter 4, “How Do I Find Out More About ELS 7.1?”	Content maps of the rest of the books in the ELS 7.1 publication set.
“ELS Terminology” on page 17	ELS terms defined.

Contents

CHAPTER 1

What is Enterprise Library Software?

Enterprise Library Software (ELS) is the software solution that enables and manages StorageTek's Automated Cartridge System (ACS) and Virtual Storage Manager (VSM) hardware.

The centerpiece of automated tape is its Library Storage Modules (LSMs) and Modular Libraries, which turn labor-intensive manual tape operations into *automated* tape. For example, the SL8500 is StorageTek's LSM offering that automates cartridge tape mounts and dismounts via HandBot High Performance™ robotics. The SL8500 is highly scalable for the short or long term. RealTime Growth™ capability, for example, means you can add more slots, drives, and robotics to handle increased workload (for example, year end processing) without disruption. The SL8500 supports any combination of StorageTek enterprise and midrange drives, which means that the SL8500 is ideal for consolidating many smaller libraries into one high-performance system. The SL8500 supports StorageTek's latest generation tape drives, the access-centric T9840D and the capacity-centric T10000B, which also provides the ability to encrypt mission-critical data.

Virtual Storage Manager (VSM) is StorageTek's virtual storage solution to the problem of inefficient use of tape media and transports. VSM solves this problem by storing virtual tape volumes (VTVs) on a disk buffer on the Virtual Tape Storage Subsystem (VTSS). VSM then migrates (and stacks) the VTVs to real automated tape volumes called multi-volume cartridges (MVCs) that are mounted on Real Tape Drives (RTDs). When needed by the host, if the migrated tape volumes are not VTSS-resident, they are automatically recalled to the VTSS. The VTSS and VTVs allow VSM to optimize access time, throughput, and physical media and transport use. VSM consists of Virtual Tape Control System (VTCS), which is the MVS host software, the portions of ELS that support VTCS, and the VTSS. The VSM5, which is the latest generation VTSS, provides significantly greater throughput and capacity than its predecessors.

The following sections discuss the ELS software components.

ELS Base Software

The ELS Base Software consists of Host Software Component (HSC), Storage Management Component (SMC), and HTTP Server, and Virtual Tape Control Software (VTCS) as shown in FIGURE 1-1.

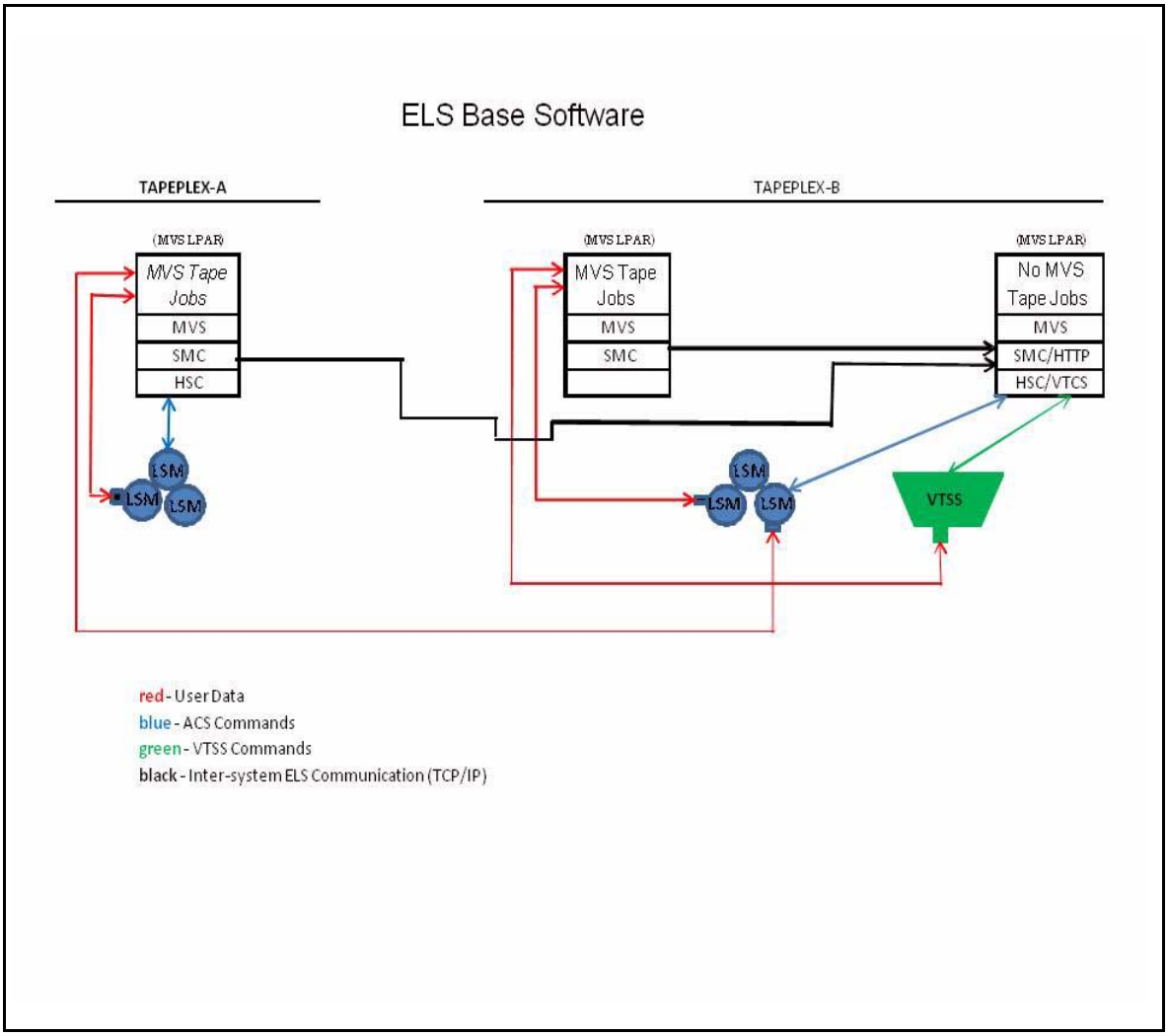

FIGURE 1-1 ELS Base Software

HSC

HSC does the following:

- Maintains the Control Data Set (CDS), which contains information about the physical and virtual drives and corresponding media in a TapePlex.
- Receives requests from SMC for mounts, dismounts, and swaps, and queries and sends these requests to the LMU, which automatically carries out these operations.
- Manages Automated Cartridge Systems (ACSs) and the LSMs that comprise ACSs.
- Manages error conditions, such as lost cartridges.

SMC and HTTP Server

SMC is the interface between IBM's z/OS operating systems and HSC and MVS/CSC. SMC is a required ELS component, and must reside on every MVS host that accesses automated real tape and/or VSM virtual tape. SMC runs on both JES2 and JES3 systems and does the following:

- Influences tape device allocation (real and virtual).
- Intercepts tape management, and operating system mount, dismount, and swap messages and creates a request for this functions and routes the request to either HSC or MVS/CSC.
- Coordinates requests among multiple StorageTek ***TapePlexes***. These requests can consist of mounts, dismounts, and swaps, and queries (configuration, volume lookup).

  A TapePlex is a single StorageTek hardware configuration, usually represented by a single HSC Control Data Set (CDS).
  A TapePlex can contain multiple ACSs and Virtual Tape Storage Subsystems (VTSSs).

SMC can communicate with any number of TapePlexes, using cross address space facilities to communicate with HSC or MVS/CSC running on the same host, and TCP/IP to communicate with HSC systems executing on other hosts.

The SMC HTTP server is a component of SMC that manages inbound TCP/IP transactions from a remote SMC client. Starting and stopping of the HTTP component is controlled with an SMC command. The HTTP component is normally started only on the host where HSC is running. For more information, see *Configuring and Managing SMC* .

VTCS

VTCS, which works as an extension to HSC/SMC, does the following:

- Influences the allocation of virtual tape drives (VTDs)
- Manages the use of VTVs
- Manages the migration and recall of virtual volumes
- Manages use of real tape media and transports used by VSM.

CDRT

The Concurrent Disaster Recovery Test (CDRT) feature is integrated into ELS and can assist customers in demonstrating their business continuance (Disaster Recovery) plan to satisfy insurance, regulatory or audit requirements by:

- Allowing ACS and VSM hardware to be shared between both a disaster recovery site and a production site simultaneously without the purchase of additional ACS or VSM hardware.
- Separating a customer-defined portion of existing ACS hardware and tape volume pools for the period of the disaster recovery test to allow concurrent use of ACS hardware.
- Supporting a parallel test of customer applications executing simultaneously from a disaster site sharing production data on the separated ACS and/or VSM hardware while concurrently running production processing using production data.
- Allows for easily combining separated hardware back into production use at the termination of the disaster recovery test without interruption of normal production processing.

LCM Software

LCM and its interaction with the ELS Mainframe Software is shown in FIGURE 1-2.

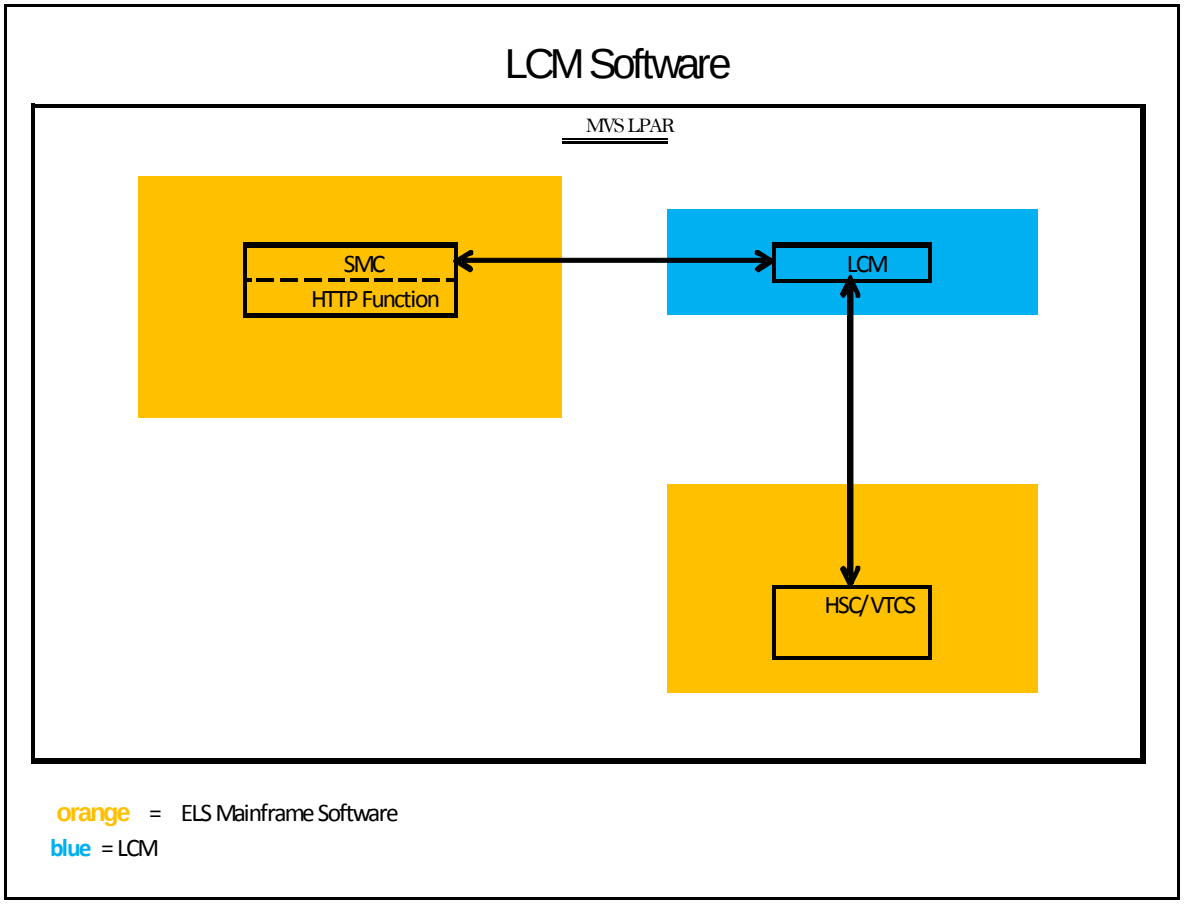

FIGURE 1-2 LCM and the ELS Mainframe Software

To help manage your ACS and VSM systems, Library Content Manager (LCM) allows you to efficiently manage ACS contents, VSM resources (MVCs and VTVs), and perform selected VSM operations (such as migration and recall).

For ELS 7.0, LCM is also the management interface for the Offsite Vault Feature, a Disaster Recovery (DR) solution that lets you vault MVCs offsite, vault volumes for Long Term Retention, and manage floor volumes.

ELS Additional Mainframe Software

The ELS Additional Mainframe Software consists of LibraryStation and MVS/CSC as shown in FIGURE 1-3.

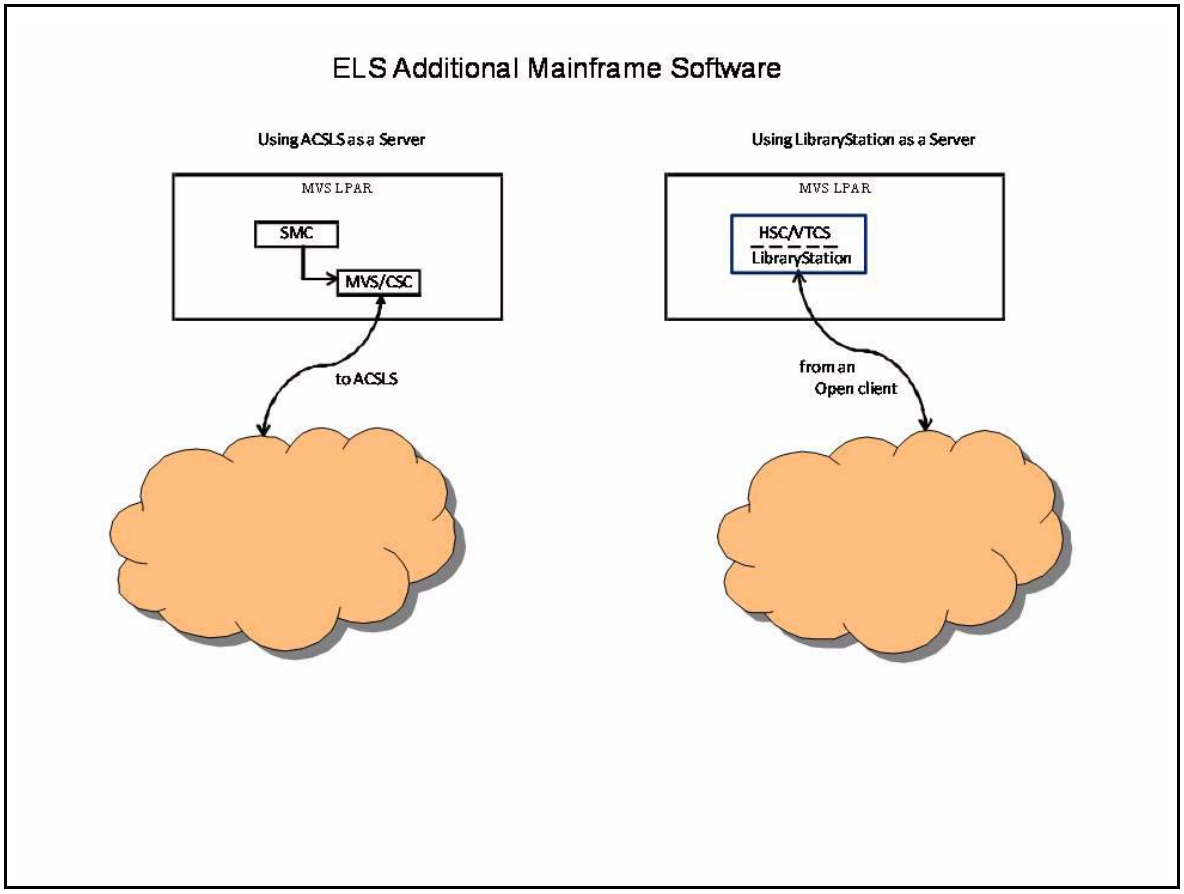

FIGURE 1-3 ELS Additional Mainframe Software

MVS/CSC and LibraryStation

MVS/CSC and LibraryStation are packaged on the ELS distribution media, but are *not* a part of the ELS 7.0 solution nor are they contained within the ELS FMID. MVS/CSC is required when your library resources are managed by ACSLS. LibraryStation is required when using non-MVS clients and HSC.

CHAPTER 2

How Does ELS Work?

How Does SMC Work?

SMC does the following:

1. Influences tape allocation based on policies, and on volume and drive characteristics supplied by HSC/VTCS:

   For example, the SMC POLICY command can be used to direct scratch allocations to either real or virtual devices, can select scratch subpools, and can assign a management class name that VTCS uses to manage virtual volumes.

2. Intercepts MVS mount, dismount, and swap messages and directs them to HSC or VTCS for automation.

SMC must execute on every host where tape processing occurs. The ELS server component (HSC/VTCS) may execute on the same z/OS host as the SMC, or may execute on a separate, remote host. When SMC and HSC/VTCS reside on different z/OS hosts, TCP/IP is used to send requests from the client host to the server host. In order to receive HTTP requests from a remote SMC client, the HTTP component must be activated on the SMC executing on the server host.

The SMC client/server feature lets you run SMC only on the client hosts and HSC/VTCS and the HTTP server on one or more server hosts. Using the SMC client/server feature provides the following benefits:

- **Reduces the number of hosts on which you run HSC/VTCS**. StorageTek recommends that you execute HSC/VTCS on only two hosts (primary and backup). Running HSC/VTCS on fewer hosts reduces CDS contention and eliminates the need to manage multiple MVS syslog files.
- **Communicates with multiple HSC/VTCS TapePlex systems** representing physically different hardware configurations.
- **Provides failover capabilities** when an HSC is recycled for maintenance.

How Does HSC Work?

HSC controls the physical tape environment. HSC, responding to requests from SMC, directs an LSM robot or handbot to mount and dismount physical tapes. HSC controls all other physical tape operations as well, including moves, swaps, and so forth. HSC also manages the CDS (Control Data Set) where information about the real and virtual tape environments is stored.

How Does VTCS Work?

Each VTSS provides 64 virtual tape drives (VTDs) for VSM2s and VSM3s, and 256 VTDs for VSM4s and VSM5s. VTDs emulate 3490E devices. VSM uses the VTDs to write data sets to virtual tape volumes (VTVs) on the VTSS. The VTSS storage is provided by a RAID-6+ DASD configuration.

VTCS is the software that controls the VTSS hardware. For example, you specify the VTSS's high and low Automatic Migration Thresholds (AMTs), which control the VTSS space management/VTV migration cycle. Real tape drives (RTDs) write migrated VTVs to physical multi-volume cartridges (MVCs). VTCS controls RTDs (although HSC provides mount and dismount services for MVCs), while HSC controls ACS tape drives that are not allocated to VSM.

If the host requests a mount of a VTV that was migrated to an MVC and is not VTSS–resident, VSM automatically recalls the migrated VTV to the VTSS. FIGURE 2-1 on page 9 shows the VTV migration/recall cycle.

Note – VSM supports dynamic sharing of RTDs between VTSSs. **Note, however, that when VTSSs share RTDs, the VTSSs must have access to all the same hosts**.

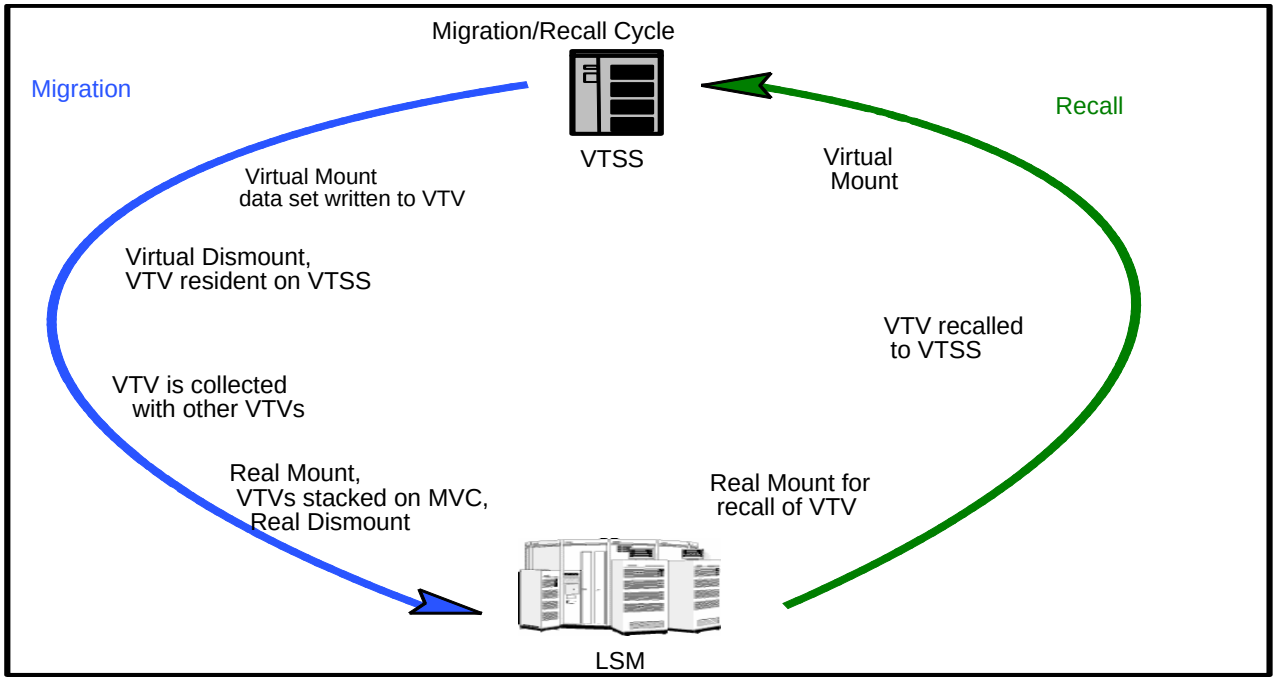

FIGURE 2-1 VTV Migration/Recall Cycle

How Does CDRT Work?

CDRT creates a test copy of the production CDS that is used by the DR hosts and therefore allows two ELS subsystems with two different CDSs to manage the same ACS hardware. The CDS reflects changes in the state of tape cartridges and resources in the ACS hardware. However, during a DR test using CDRT, the two ELS subsystems use two different CDSs, and do not communicate. Thus changes that occur in the production CDS are not reflected in the test CDS copy and visa versa. CDRT acts to segregate the test ACS and VSM hardware from the production ACS and VSM hardware, managing the DR test to ensure the integrity of the production data and minimizing conflicts for tape volumes and ACS hardware resources. Central and fundamental to a successful DR test using CDRT is a valid point-in-time copy of the state of all tape volumes managed by ACS and/or VSM hardware and the ELS subsystem. In a tape volume environment, quite often some of this tape volume state data (metadata) is retained and managed outside of the ELS subsystem and ACS/VSM hardware. Typically, tape volume metadata (i.e. VOLSER, DSN, Expiration date, scratch status, real or virtual designation, etc.) is stored in one or more Tape Management Catalogs (TMCs), one or more z/OS catalogs and the CDS. Ensuring that the state of tape volumes as reflected on host systems is either the same or equivalent on both production hosts and DR hosts, is critical to successful execution of a DR test. This consistency in the state of tape volumes between the production hosts and the DR hosts at the start of the DR test is what allows the parallel processing of customer applications to assist in validating a business continuance plan. The DR test hosts exercise the segregated hardware while production hosts continue using both the non-segregated and segregated ACS hardware.

The DR test hardware is a minimum of one ACS. Optionally, one or more VTSSs may be employed as DR test hardware. The ACS is shared between the production hosts and the DR hosts. The DR hosts have exclusive use of any segregated VTSSs during the DR test. To produce valid point-in-time copies of any TMCs and z/OS catalogs, see the appropriate 3rd party software documentation. At the end of a DR test, all data created from the DR test hosts, including the test copy of the CDS is typically discarded and the segregated hardware is redeployed back to the normal production environment

CHAPTER 3

What Enhancements Does ELS 7.1 Offer?

The following sections describe the ELS 7.1 enhancements.

SMC 7.1 Enhancements

SMC 7.1 provides the following enhancements:

- In SMC7.1 the ability to derive TAPEPLEX definitions based on locally defined subsystems is removed. Instead, all TAPEPLEXes must be defined using the TAPEPLEX command. If no TAPEPLEX commands are found at SMC startup, the SMC subsystem terminates.

  In ELS 7.0 and above the SMC TapePlex name is automatically inserted into the HSC CDS and is used for HSC statistical reporting. HSC also provides a SET TAPEPLEX utility function to change the TapePlex name in the CDS if desired.
- The SMC HELP command displays SMC command and message information.
- The messages produced by SMC utility programs are renumbered. The previous messages SMCU0nnn are changed to SMC5nnn.

HSC 7.1 Enhancements

The use of the decimal library location representation will allow clients to be server agnostic whether they are communications with HSC or ACLS, and avoids the complexity of supporting formats for both products. The change to decimal locations affects the following areas:

- *Changes to command input.*All HSC commands that accept ACS, LSM or CAP input now require the ACS, LSM and CAP to be specified in decimal rather than hexadecimal. “Old” format commands (such as AAL to represent an ACS/LSM combination) are no longer accepted. All commands where both ACS and LSM are input require a format of AA:LL.
- *Output changes*. All command, report, and XML output fields that contain ACS, LSM and CAP Ids are now in decimal rather than hexadecimal format.
- *Flat file support.* Although flat files are currently described as a “deprecated interface” in the product, the support is being retained in ELS 7.1. The layout of flat files remains unchanged, but the format of ACS and LSM Ids are changed for hexadecimal to decimal.

VTCS 7.1 Enhancements

ELS 7.1.0 offers a unique resolution to the issue of excessive MVC reclaim resource consumption. Reclaim is the process of freeing areas of tape media (MVCs) that are occupied by stale data. As tape media is sequential a standard reclaim will consist of recalling active VTVs from an MVC to a VTSS and then remigrating the VTVs. This consumes:

- VTSS resources
- VTSS nearlink channels
- One or more RTDs
- One or more MVCs.

With ELS 7.1 the reclaim process can consume far less resources and have less impact on production workload. ELS 7.1 will exploit the Dynamic Reclaim feature of the T10000B transport. This unique offering enables MVC media to be reclaimed with less data movement in that areas of tape occupied by stale data can now be re-used in place.

To exploit this capability requires:

- All hosts running ELS to be at version 7.1.0
- The CDS to be converted to a VTCS “H” level CDS (this is a non disruptive change)
- The installation of supporting code levels on the T10K drives used as RTDs and the VTSS systems.
- Modify the VTCS `CONFIG` and `STORCLAS` definitions to initiate reclaim in place.

In version 7.1 you can set separate RECLAIM thresholds for standard and in place RECLAIM. An in-place reclaim:

- Will happen at lower levels of fragmentation than standard reclaim
- Can reclaim an MVC without even mounting the MVC
- Will reduce the amount of standard RECLAIMs that are required to manage your MVCPools.
- Increases the effective capacity of the media used for MVCs.

For more information, see *Configuring HSC and VTCS*.

LCM 7.1 Enhancements

LCM 7.1 requires that all ELS components (SMC, HSC and VTCS) also be at the 7.1 release level. The LCM 7.1 enhancements consist of the following:

- *Support for Dynamic Reclaim*. LCM 7.1 makes two significant changes to support Dynamic Reclaim function provided by VTCS 7.1:
  - In the REPORT MULTIPLE output, the Initialization column (“I”) now shows a P for an initialized MVC in partitioned format, which is required for Dynamic Reclaim.
  - In the REPORT MULTIPLE DETAIL output, the Partition ID (ID) used for each VTV on a partitioned MVC is shown in addition to the starting block number. Note that the starting block number is now referenced to either the original write on the MVC or from the starting point of a series of writes following a RECLAIM.

  Note that once an MVC has been created in the partitioned format, it will be indicated as a partitioned MVC until such time that it is used in the standard format.
- *Support for decimal library locations*. As described in “HSC 7.1 Enhancements” on page 11, ELS 7.1, including LCM, changes library addresses to decimal. LCM 7.1 supports this change and will require minor adjustments to existing parameters used by ExLM or LCM to reflect these addressing changes. This should only affect customers with more than 10 LSMs in an ACS and SL3000 library customers that currently have a CAP ID of '0A' or a CAP ID of ' 0B' in use.
- *Extended field support added for DFSMSrmm user*s. As was previously provided for users of the CA-1, CA-TLMS and Control-T tape management systems, LCM 7.1 provides 'raw' (non-normalized) volume metadata fields for users of the IBM DFSMSrmm (RMM) tape management system when using the extract file created by IBM's EDGHSKP utility. These volume metadata fields may be used for either/both selection criteria or output criteria for LCM functions.
- *CSV report output*. In addition to the existing PRINT and DATA output formats for LCM Custom Reports, LCM 7.1.0 adds two versions of Comma Separated Value (CSV) outputs:
  - Standard – Values are separated by commas, leading/trailing blanks are included.
  - Trim -Values are separated by commas with leading/trailing blanks removed.

  This change allows report outputs to be easily used by spreadsheet applications.
- *Support for multiple local servers*. LCM 7.1 supports operation when more than one local server (HSC/VTCS) is present on the host where LCM is executing. On such a host, LCM requires an additional TAPEPLEX(tapeplex_name) parameter which is included in the parameters on the EXEC card in the JCL.

  Should two local servers be encountered without the specification of the TAPEPLEX parameter, LCM will not run and end with an appropriate message.

CHAPTER 4

How Do I Find Out More About ELS 7.1?

Now that you have an overview of ELS 7.1 and what it can do, what's next? The following tables describe the rest of the ELS information set by title and contents.

TABLE 4-1 ELS Solution Books

This book...	...contains the following information...
Introducing ELS (this book)	Overview of the entire ELS 7.1 solution.
Installing ELS	Installing all ELS 7.1 mainframe software.
ELS Command, Control Statement, and Utility Reference	A single, common reference for HSC, SMC, and VTCS.
ELS Quick Reference	A single, common quick reference for HSC, SMC, and VTCS.
ELS Programming Reference	Other programming interfaces besides commands, control statements, and utilities, including the Significant Event Notification Facility, HSC LOGREC records, all SMF records, HSC User Exits 6, 14 and 15, and HSC LIBGEN macros. Also information on writing programs to the ELS Unified User Interface (UUI) and using the UUI to produce XML or CSV output of ELS commands and utilities.
ELS Legacy Interfaces Reference	Interfaces that are still supported for ELS 7.1 but whose use is *strongly deprecated*; to include but not limited to all other User Exits, HSC PGMI, HSC Batch API, old TAPEREQ format, old DFSMS interface information.
ELS Messages and Codes	A single, common messages and codes for HSC, SMC, and VTCS.
ELS Disaster Recovery and Offsite Data Management Guide	Using ELS for Disaster Recovery (DR) and managing offsite data.

TABLE 4-2 HSC/SMC/VTCS Books

This book...	...contains the following information...
Configuring HSC and VTCS	How to configure these components for both new and existing customer sites.
Managing HSC and VTCS	Managing HSC, including an overview of HSC management tools and periodic and as-needed management tasks. Managing VTCS, including an overview of VTCS management tools, periodic and as-needed management tasks, and finding and fixing VTCS problems. This book also unlocks the value add in your VSM system through discussions of Management Class and Storage class basics and implementation scenarios.
Configuring and Managing SMC	Configuring and managing SMC, including implementing and managing device allocation, Tapeplexes, and storage policies.

TABLE 4-3 LCM Books

This book...	...contains the following information...
LCM User's Guide	Using LCM to manage your ACS and VSM resources and processes.
LCM Quick Reference	
LCM Messages and Codes	

TABLE 4-4 LibraryStation Books

This book...	...contains the following information...
LibraryStation Configuration and Administration Guide	Configuring and administering this product. For more information, see "MVS/CSC and LibraryStation" on page 6.

TABLE 4-5 MVS/CSC Books

This book...	...contains the following information...
MVS/CSC Configuration Guide	Configuring and administering this product. For more information, see "MVS/CSC and LibraryStation" on page 6.
MVS/CSC Messages and Codes	
MVS/CSC Operator's Guide	
MVS/CSC System Programmer's Guide	
MVS/CSC Quick Reference	

APPENDIX **A**

ELS Terminology

The following table describes the terms and abbreviations associated with ELS.

TABLE A-1 ELS Terms and Acronyms

Term	Description
ACS	(1) StorageTek's Automatic Cartridge System. (2) A multi-LSM configuration.
ACS routine	An SMS term, referring to automatic class selection routine. Not to be confused with the HSC term, ACS, referring to Automatic Cartridge System.
ACSLS	ACSLS (Automated Cartridge System Library Software) enables Automated Tape Libraries to be shared in a heterogeneous environment and functions as the central service provider for library operations in a open-systems environment.
AMT	Automatic migration threshold. AMT values are user–defined percentage values that determine when virtual tape volume migration begins and ends. VTV migration begins when the VTSS buffer reaches the high AMT and ends when the buffer reaches or falls below the low AMT. These thresholds apply to all VTSSs.
CAP	An assembly that allows several cartridges to be inserted into or ejected from an LSM without human entry into the LSM.
CDS	Control data set. The HSC database. In addition to the current information in the CDS, VSM keeps all its persistent data in the CDS as well.

TABLE A-1 ELS Terms and Acronyms

Clustered VTSS Configuration	A configuration that consists of a Primary VTSS and a Secondary VTSS connected by one or more Nearlink connections (cluster links). You can use the MGMTclas statement REPLICAT parameter (which requires the Advanced Management Feature) to direct the Primary VTSS to replicate (copy) a VTV to the Secondary VTSS via a cluster link. If the Primary VTSS becomes unavailable, you can use the VT VARY VTSS command to vary it offline to VTCS. You then vary the Secondary VTSS's VTDs online to MVS to continue the workload. The Secondary, therefore, acts as a "warm standby" to the Primary VTSS.
DBU	Disk buffer utilization. The ratio of used to total VTSS buffer capacity.
HSC	Sun StorageTek Host Software Component.
HSM	Hierarchical Storage Manager.
LMU	A Library Management Unit that controls one or more LSMs.
LSM	A Library Storage Module that contains storage cells for cartridges, drive panels, and CAPs.
Migration	The movement of data from the VTSS to the RTD where VTVs are stacked onto MVCs. Migration is initiated by VSM when high AMT levels are reached. VTVs are selected for migration based on use and size: the least recently used and the largest VTVs are selected first. VSM provides the ability to migrate VTVs on demand and to migrate multiple copies of the VTV.
MVC	Multi–volume cartridge. The physical cartridge in the LSM that contains one or more VTVs or no VTVs, but has been identified as a volume that can be selected for VTV stacking. This data is stored in the CDS.
Recall	The movement of VTVs back to the VTSS from the MVC. VSM provides the ability to recall VTVs on demand.
Reclaim	Refers to MVC space reclamation. VTCS uses the amount of fragmented free space on the MVC and the amount of VTV data that would have to be moved to determine if space reclamation is justified. VSM provides the ability to reclaim MVCs on demand.
RTD	Real Tape Drive. The physical transport controlled by VSM/HSC. The transport has a data path to a VTSS and may optionally have a data path to MVS or to another VTSS.

TABLE A-1 ELS Terms and Acronyms

SMC	Sun StorageTek Storage Management Component, which is the interface between IBM's z/OS operating systems and HSC and MVS/CSC.
SMS	System Managed Storage
TMM	Tape Mount Management
VSM	Virtual Storage Manager. A storage solution that virtualizes volumes and transports in a VTSS buffer in order to improve media and transport use. The hardware includes VTSS, which is the disk buffer, and RTDs. The software includes VTCS, an HSC–based host software, and VTSS microcode.
VTCS	Virtual Tape Control System. The primary host software that controls activity and information about VTSSs, VTVs, RTDs, and MVCs. This software operates in the same address space from HSC, and communicates closely with HSC.
VTD	Virtual Tape Drive. A transport in the VTSS that emulates a physical 3490E to MVS. The data written to a VTD is really being written to disk. The VTSS has 64 VTDs that do virtual mounts of VTVs.
VTSS	Virtual Tape Storage Subsystem. The disk buffer containing virtual volumes and transports. The VTSS is a StorageTek RAID 6+ hardware device with microcode that enables emulation of 32 or 64 transports. The RAID device can read and write "tape" data from/to disk, and can read and write the data from/to an RTD.
VTV	Virtual Tape Volume. The "cartridge" whose volume number is known to the MVS catalog and the TMS (Tape Management System) as a tape data set.

APPENDIX **B**

Additional Information

Oracle Corporation (Oracle) offers several methods for you to obtain additional information.

Oracle’s External Web Site

Oracle’s external Web site provides marketing, product, event, corporate, and service information. The external Web site is accessible to anyone with a Web browser and an Internet connection. The URL for the Oracle external Web site is: http://www.oracle.com/us/index.html

The URL for Oracle’s StorageTek storage information for is:

http://www.oracle.com/us/products/servers-storage/storage/index.html

Oracle’s StorageTek Documentation

The URL for Oracle’s StorageTek documentation is:

http://docs.sun.com/app/docs

Oracle Global Partners

The Oracle Global Partners site provides information about solutions available with Oracle’s partners:

http://www.oracle.com/partners/index.html

Third-Party Web Sites

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Oracle’s Global Offices

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http://www.oracle.com/corporate/contact/global.html

Customer Support

For more information about Oracle support (including for StorageTek branded products) see:
http://www.oracle.com/us/support/index.html

Conventions for Reader Usability

Conventions are used to shorten and clarify explanations and examples within this book.

Typographic

The following typographical conventions are used in this book:

- **Bold** is used to introduce new or unfamiliar terminology.
- Letter Gothic is used to indicate command names, filenames, and literal output by the computer.
- Letter Gothic Bold is used to indicate literal input to the computer.
- *Letter Gothic Italic* is used to indicate that you must substitute the actual value for a command parameter. In the following example, you would substitute your name for the "username" parameter.
- Logon *username*
- A bar (|) is used to separate alternative parameter values. In the example shown below either username or systemname must be entered.
- Logon *username*|*systemname*
- Brackets [ ] are used to indicate that a command parameter is optional.
- Ellipses (...) are used to indicate that a command may be repeated multiple times.
- The use of mixed upper and lower case characters (for non–case sensitive commands) indicates that lower case letters may be omitted to form abbreviations. For example, you may simply enter **Q** when executing the **Quit** command.

Keys

Single keystrokes are represented by double brackets [[ ]] surrounding the key name. For example, press [[ESC]] indicates that you should press only the escape key.

Combined keystrokes use double brackets and the plus sign (+). The double brackets surround the key names and the plus sign is used to add the second keystroke. For example, press [[AL]] + [[C]] indicates that you should press the alternate key and the C key simultaneously.

Enter Command

The instruction to "press the [[ENTER]] key" is omitted from most examples, definitions, and explanations in this book.

For example, if the instructions asked you to "enter" **Logon pat**, you would type in **Logon pat** *and* press [[ENTER]].

However, if the instructions asked you to "type" **Logon pat**, you would type in **Logon pat** and you would *not* press [[ENTER]].

Warnings, Cautions, and Notes - Software

The following are used in software documentation.

Caution – Information necessary to keep you from corrupting your data.

Tip – Information that can be used to shorten or simplify your task or they may simply be used as a reminder.

Note – Information that may be of special interest to you. Notes are also used to point out exceptions to rules or procedures.

Warnings, Cautions, and Notes - Hardware

The following are used in hardware documentation.

Note – A note provides additional information that is of special interest. A note might point out exceptions to rules or procedures. A note usually, but not always, follows the information to which it pertains.

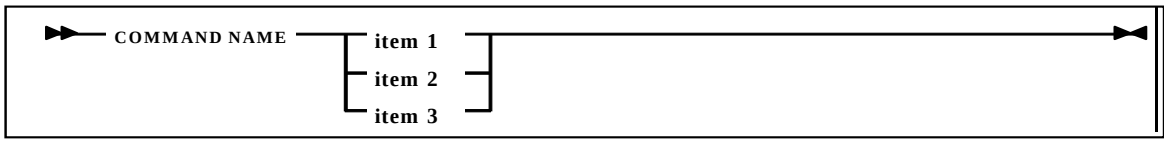
Caution – A caution informs you of conditions that might result in damage to hardware, corruption of data, or corruption of application software. A caution always precedes the information to which it pertains.

Warning – Possible Physical Injury. A warning alerts you to conditions that might result in long-term health problems, injury, or death. A warning always precedes the information to which it pertains.

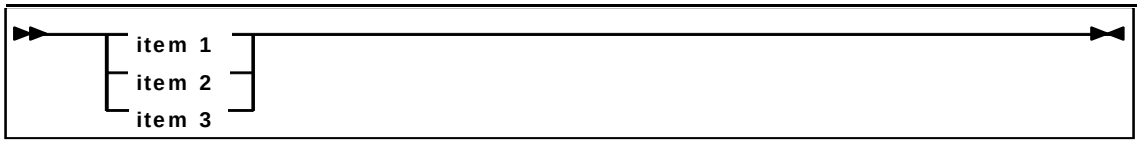
Syntax

Syntax flow diagram conventions include the following:

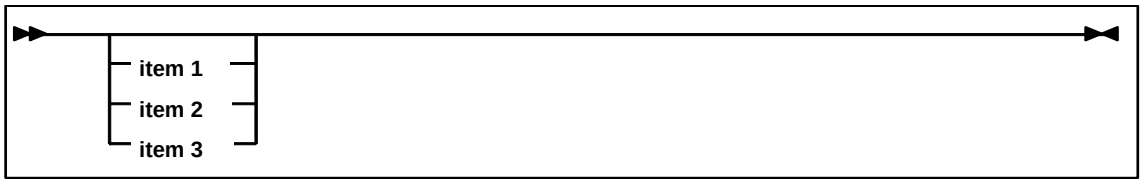
Flow Lines—Syntax diagrams consist of a horizontal baseline, horizontal and vertical branch lines and the command text. Diagrams are read left to right and top to bottom. Arrows show flow and direction.



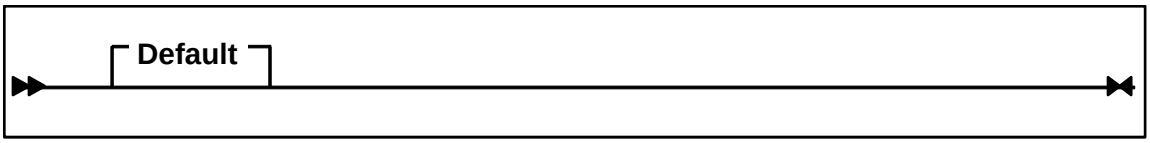
Single Required Choice—Branch lines (without repeat arrows) indicate that a single choice must be made. If one of the items to choose from is on the baseline of the diagram, one item must be selected.



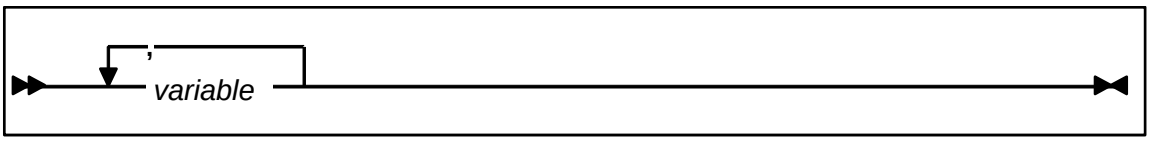
Single Optional Choice—If the first item is on the line below the baseline, one item may optionally be selected.



Defaults—Default values and parameters appear above the baseline.



Repeat Symbol—A repeat symbol indicates that more than one choice can be made or that a single choice can be made more than once. The repeat symbol shown in the following example indicates that a comma is required as the repeat separator.



Keywords—All command keywords are shown in all upper case or in mixed case. When commands are not case sensitive, mixed case implies that the lowercase letters may be omitted to form an abbreviation.

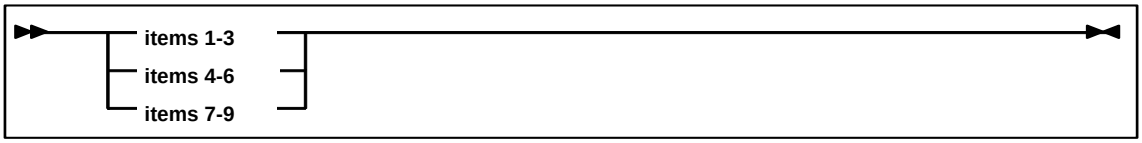
Variables—Italic type is used to indicate a variable.

Alternatives—A bar (|) is used to separate alternative parameter values.

Optional—Brackets [ ] are used to indicate that a command parameter is optional.

Delimiters—If a comma (,), a semicolon (;), or other delimiter is shown with an element of the syntax diagram, it must be entered as part of the statement or command.

Ranges—An inclusive range is indicated by a pair of elements of the same length and data type, joined by a dash. The first element must be strictly less than the second element.



Lists—A list consists of one or more elements. If more than one element is specified, the elements must be separated by a comma or a blank and the entire line must be enclosed by parentheses.